

## **Historic, Archive Document**

Do not assume content reflects current scientific knowledge, policies, or practices.



A289.9  
R31  
cop. 2

ARS 52-10

April 1966

U. S. DEPT. OF AGRICULTURE  
NATIONAL AGRICULTURAL LIBRARY

WATER - 255  
CURRENT SERIAL RECORDS

# Prepackaging Pole Beans in Trays and Polyethylene Bags



## PREFACE

This report is one of a series reporting on research undertaken by the Agricultural Research Service to develop improved consumer packages and shipping containers for agricultural products. This packaging research program is aimed at reducing the cost of marketing agricultural products and improving the quality of products available to consumers.

A number of individuals and organizations engaged in the packing, shipping, and marketing of fresh pole beans cooperated in this study by furnishing the beans, packing facilities, and labor, and assisted in conducting various experiments in bean packing plants, and test shipments. These include:

Florida Fruit and Vegetable Association, Orlando, Fla.

Ike Gordy, Manager, Thomas County Pre Pak Association, Princeton, Fla.

Eric Schmidt, Manager, and William Thompson, Plant Manager, Frontier Prepacking Co., Princeton, Fla.

Richard M. Reese, Managing Director, Corrugated Container Institute, Lakeland, Fla.

Thomas Behr, Field Produce Buyer, Orlando, and D. J. Olimpio, Produce Merchandiser, Landover, Md., The Grand Union Co.

The assistance and cooperation supplied by the above individuals, firms, and associations are gratefully acknowledged.

## CONTENTS

	<u>Page</u>
Summary . . . . .	4
Introduction . . . . .	5
Procedure . . . . .	5
Descriptions of packaging materials . . . . .	6
Trays . . . . .	6
Bags . . . . .	7
Master shipping containers . . . . .	7
Methods of packing . . . . .	7
Trays . . . . .	7
Bags . . . . .	9
Direct labor and material costs . . . . .	9
Weight loss . . . . .	10
Sales in retail stores . . . . .	10

## SUMMARY

Fresh pole beans can be prepackaged at point of production and delivered successfully to market. About 16,000 master containers of fresh pole beans packed in molded pulp trays and polystyrene plastic trays overwrapped with polyvinyl chloride heat-shrinkable films and in polyethylene bags were shipped from Florida during the 1964-65 season. Condition of the prepackaged pole beans upon arrival at warehouses and retail stores was excellent.

The salability of pole beans prepackaged in polystyrene trays, pulp trays, and polyethylene bags, and of beans displayed loose, was measured by rotating displays in four stores for 4 weeks. Beans sold during this test period by type of display were: Polystyrene trays, 332 pounds; loose, 288 pounds; pulp trays, 267 pounds; and polyethylene bags, 256 pounds.

Consumer packages should be slightly overpacked to allow for some moisture loss and to maintain their labeled net weight at time of sale in retail stores. Additional weight of 1 ounce for trays and 0.6 ounce for bags is needed per pound of beans prepackaged. Under simulated retail display conditions, prepackaged pole beans remained green and in fresh condition from 1 to 3 days longer than nonpackaged beans.

The cost of materials and labor for packing 1-1/4 pounds of pole beans in three different consumer packages in Florida production areas was 6.8 cents for polyethylene bags, 7.0 cents for pulp trays, and 8.0 cents for polystyrene trays.



# PREPACKAGING POLE BEANS IN TRAYS AND POLYETHYLENE BAGS

by Philip W. Hale and Earl D. Mallison<sup>1</sup>

## INTRODUCTION

Growers and shippers of pole beans<sup>2</sup> have been interested in consumer packaging pole beans to help expand their markets, particularly in Northern and Eastern States where consumers are less familiar with pole beans than they are in most Southern States. Prepackaging pole beans offers several advantages to retailers: (1) Added protection against shrinkage and dehydration, (2) more efficient use of in-store labor, and (3) improved appearance and salability of the beans.

The objectives of this study were to determine (1) the physical feasibility of prepackaging fresh pole beans at point of production and shipping them to distant markets, (2) the cost of prepackaging beans in polystyrene and pulp trays and in polyethylene bags, and (3) the salability of pole beans displayed in retail stores in these packages and displayed loose.

## PROCEDURE

The bean packaging experiments were made during the 1964-65 season on two commercial packaging lines located in southern Florida. Twenty to thirty workers were employed on the line to package beans in trays, and twelve to eighteen on the line used to package beans in polyethylene bags. Part of the beans were packaged in molded pulp trays and polystyrene plastic trays, and part in polyethylene bags. The costs of packaging materials and direct labor to prepackage beans in these three different packages were obtained.

Four holding tests to measure the amount of moisture loss of packaged and nonpackaged beans held in constant temperature rooms for a total of 8 days were made in Orlando, Fla. The beans were held 2 days at 50<sup>0</sup> F. and 80 percent relative humidity to simulate transit conditions and an additional 6 days at 70<sup>0</sup> F. and 80 percent humidity to simulate wholesale and retailing conditions.

The prepackaged beans were marketed in northern and eastern terminal markets, and the salability of beans in the three experimental packages and of beans displayed loose was determined by conducting sales tests in four stores located in the Washington, D.C., area. The condition of the beans on arrival at warehouses and retail stores was examined. A latin square experimental design was used to measure salability of the packaged and loose beans.

---

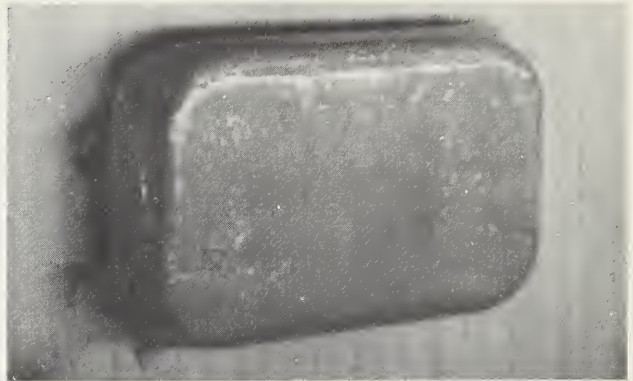
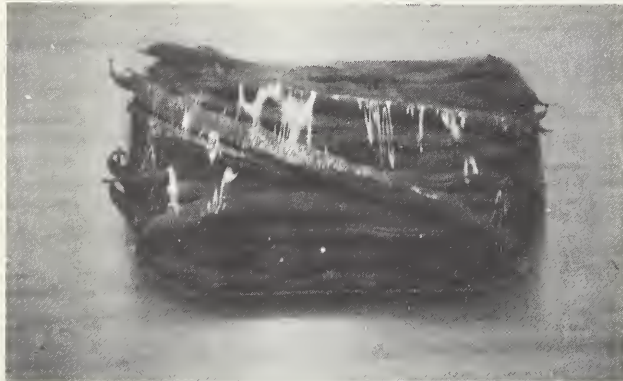
<sup>1</sup> Agricultural economist and agricultural marketing specialist, Transportation and Facilities Research Division, Agricultural Research Service, USDA.

<sup>2</sup> Strains of McCaslan pole beans—green, flat beans averaging about 7-1/2 inches in length.

# DESCRIPTIONS OF PACKAGING MATERIALS

## Trays

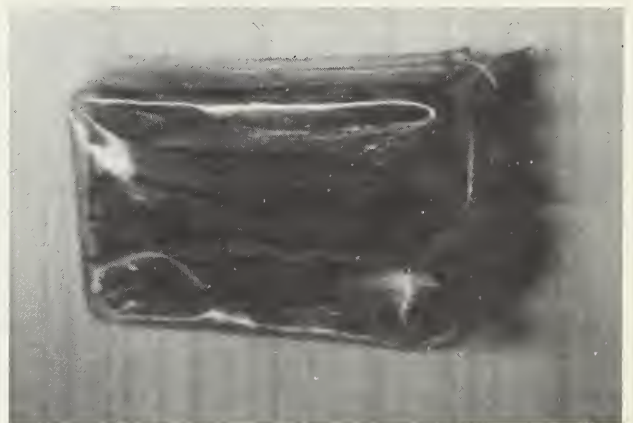
The molded pulp trays are green and have inside dimensions of  $8\frac{3}{4} \times 6 \times 1$  inches. The pulp trays were filled with  $1\frac{1}{4}$  pounds<sup>3</sup> of pole beans and were banded with  $\frac{3}{4}$ -mil polyvinyl chloride heat-shrinkable film (fig. 1, A and B).



BN-26494, BN-26536

Figure 1.--Molded pulp tray filled with pole beans and banded with heat-shrinkable film: A, left; B, right.

The inside dimensions of the transparent polystyrene trays are  $8\frac{7}{8} \times 5\frac{5}{8} \times 1\frac{5}{8}$  inches. The polystyrene trays were filled with  $1\frac{1}{4}$  pounds of beans and were banded with  $\frac{3}{4}$ -mil polyvinyl chloride heat-shrinkable film (fig. 2, A and B).



BN-26495, BN-26534

Figure 2.--Transparent polystyrene tray for pole beans banded with heat-shrinkable film: A, left; B, right.

---

<sup>3</sup>Some produce merchandisers consider 1,  $1\frac{1}{2}$ , or 2 pounds as desirable net weights for sale in retail stores. However, the trays evaluated in this study appeared slack and unattractive when packed with 1 pound of pole beans, and were not large enough for  $1\frac{1}{2}$  and 2 pounds. Consequently, all trays and bags evaluated were packed with  $1\frac{1}{4}$ -pound net weights, plus an additional 1.5 to 2.0 ounces to compensate for moisture loss.



## Bags

The 7- by 13-inch bags, made of 1-1/4-mil polyethylene film, were printed in three colors. The net weight, name and address of the packer, and a recipe for cooking the beans were printed on the bag. Ventilation was provided by thirty-six, 1/4-inch holes in the side panels (gussets) of the bag. Each bag was packed with 1-1/4 pounds of pole beans and was closed by sealing the top with an automatic heat-sealing machine (fig. 3).



Figure 3.--Polyethylene bag filled with pole beans and sealed at top.

BN-26535

## Master Shipping Containers

The two-piece master shipping container was manufactured from 275-pound test fiberboard. Inside dimensions of the box were 18-3/4 by 17-3/8 by 7-1/4 inches. These containers were used in shipping both the trays and the bags and each held eighteen, 1-1/4-pound units.

## METHODS OF PACKING

Pole beans packed in 28-pound hampers were delivered to packing sheds directly from the fields. The hampers were placed in cold storage rooms and held there until the beans were cooled to 45° F. Beans were taken from the cooling rooms and poured into an automatic vibrating machine that alined them lengthwise on a moving belt. Workers then removed imperfect or damaged beans from the belt.

## Trays

Workers picked the graded beans from the moving belt and placed them in molded pulp or polystyrene trays (fig. 4). The filled trays were check-weighed at a station on the packing line so that each tray held the same weight of beans. After weighing, the trays were placed on a conveyor belt that carried them to a machine, which automatically sleeve-wrapped them with a heat-shrinkable film. The wrapped trays then moved through a heat tunnel that shrank the film tight around each filled tray (fig. 5). A label and a recipe were placed on each tray. The trays were then packed in master shipping boxes, and placed in refrigerated storage rooms to await shipment.



BN-26552

Figure 4.--Workers filling tray packages with pole beans from conveyor belt.



BN-26553

Figure 5.--Rotating table carries packages of pole beans just emerging from heat tunnel (background) to workers who place them in a master container.



## Bags

Methods of alining and grading the precooled beans on moving belts of the bag packing line were the same as those used on the lines for packaging beans in trays.

Handfuls of beans were taken from the moving belt and placed on scales. When the correct weight was obtained, the beans were placed in metal cups attached to the chain belt of a semi-automatic filling machine. These filled cups rotated over a central filling chute, dropping the beans directly into polyethylene bags (fig. 6). As bags were filled, they were placed on a table where workers rearranged the beans inside the bag to make a neat package. The bags were set upright on a conveyor belt that carried them through a heat-sealing machine. After closing, the bags were check-weighed, packed in master shipping containers, and held in cold storage until shipped to terminal markets.



BN-26551

Figure 6.--Worker removing filled polyethylene bag from central filling chute.

## DIRECT LABOR AND MATERIAL COST

Direct labor costs to package pole beans in trays were lower than costs to package them in bags. The average cost of direct labor was 3.4 cents for packaging 1-1/4 pounds of beans in polystyrene and pulp trays and 3.8 cents for polyethylene bags (table 1).

TABLE 1.--Cost of packaging materials and direct labor to pack 1-1/4 pounds of fresh pole beans in three consumer packages, Florida, 1964-65.<sup>1</sup>

Type of package	Packaging materials	Labor <sup>2</sup>	Total
	<u>Cents</u>	<u>Cents</u>	<u>Cents</u>
Polyethylene bag.....	3.0	3.8	6.8
Pulp tray.....	3.6	3.4	7.0
Polystyrene tray.....	4.6	3.4	8.0

<sup>1</sup>Management, equipment, depreciation, taxes, interest, insurance, or other overhead and fixed costs are not included.

<sup>2</sup>Direct labor costs are based on an assumed wage of \$1.25 per hour and include only labor directly connected with packaging operations. Labor for packing the 1-1/4-pound polyethylene bags is based on experimental runs of small test lots.

The total cost of packaging materials for each package listed in table 1 includes cost of bag, or tray including overwrap, label, and recipe, and proportional part of the master container.

Costs of direct labor and materials were about the same for polyethylene bags and pulp trays, 6.8 and 7.0 cents each, respectively, and 8.0 cents for the polystyrene tray.

## WEIGHT LOSS

The weight or moisture loss during a simulated 2-day transit period at 50° F. and 80 percent relative humidity averaged less than 1 percent for packaged beans and 2.5 percent for bulk or unpackaged beans (fig. 7).

After the beans had been held an additional 6 days at 70° F. to simulate wholesaling and retailing conditions, the accumulated loss in weight in the beans packed in polyethylene bags was 5.3 percent; overwrapped polystyrene trays, 6.9 percent; and overwrapped pulp trays, 7.8 percent. Under the same conditions, nonpackaged beans lost 10.5 percent in weight.

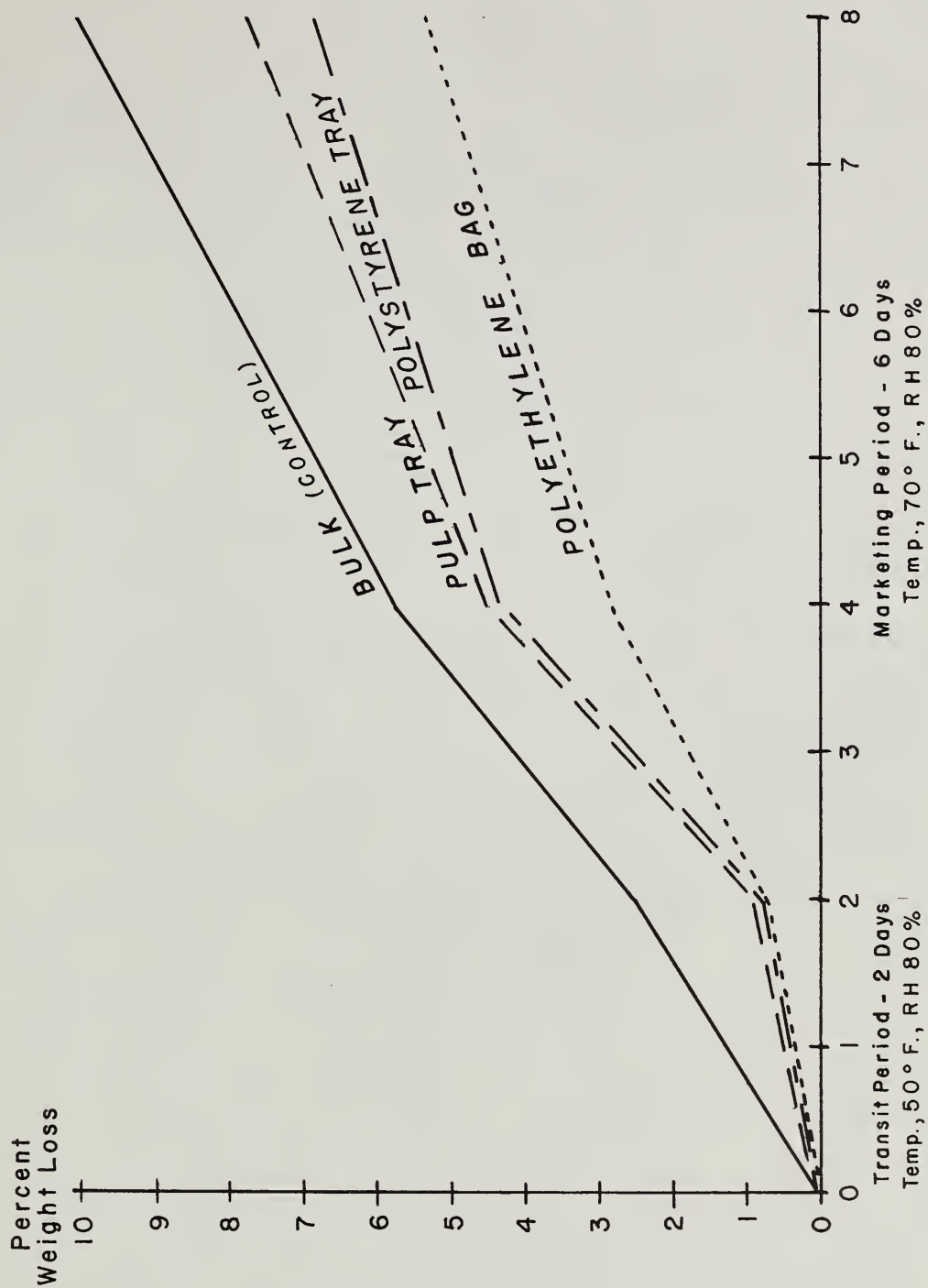
Pole beans in the 1-1/4-pound consumer packages usually remained fresh, green, and in good condition from 1 to 3 days longer than comparable beans displayed loose.

Based on information presented in figure 7, trays require an overweight allowance of 1 ounce, and bags 0.6 ounce, for each pound prepackaged to maintain the weight shown on the label during the time they are on retail display.

## SALES IN RETAIL STORES

The beans arrived at market outlets in excellent condition. Sales of beans packaged in the polystyrene trays were 332 pounds; loose, 288 pounds; pulp trays, 267 pounds; and polyethylene bags, 256 pounds. The difference in sales between pole beans displayed in polystyrene trays and those displayed loose or in pulp trays or in polyethylene bags was significant at the 90-percent level; other differences in sales between treatments were not statistically significant. The retail price of beans in the trays and the polyethylene bag was 35 cents for 1-1/4 pounds. Loose beans sold for 29 cents a pound.

WEIGHT LOSS OF McCASLAN POLE BEANS IN CONSUMER PACKAGES AND  
IN BULK DURING SIMULATED TRANSIT AND MARKETING PERIODS\*



\*Average of 4 tests, Florida, 1964-65

Figure 7.



UNITED STATES DEPARTMENT OF AGRICULTURE  
Agricultural Research Service  
Hyattsville, Maryland 20782

Postage and Fees Paid  
U. S. Department of Agriculture

---

Official Business

Slight condensation of moisture occurred on the inside of the film bags and film overwrapped trays. After the packaged beans had remained on display for several hours, an accumulation of moisture generally appeared on individual beans and bottoms of overwrapped polystyrene trays and polyethylene bags. Moisture did not form on the bottom of molded pulp trays, because it was absorbed by the pulp. Periodic examination of packaged beans displayed in retail stores showed no noticeable signs of decay or mold for a period of 5 days.

Produce managers of four cooperating stores interviewed at the end of a 4-week period preferred the all-around visibility of polystyrene trays and polyethylene bags over the partial visibility given by overwrapped pulp trays.

Receivers of commercial shipments of prepackaged pole beans in other markets, such as New York, also expressed a preference for the beans packaged in the transparent polystyrene trays.

During the 1964-65 season, Florida shippers sold about 16,000 boxes of prepackaged fresh pole beans--about 8,000 boxes of beans packaged in polystyrene trays, 6,000 in polyethylene bags, and 2,000 in pulp trays.